N92-10751

TECTONIC SETTING OF MARTIAN VOLCANOES AND DEEP-SEATED INTRUSIVES

D.H. Scott and J.M. Dohm, U.S. Geological Survey, Flagstaff, AZ 86001

More than 50 volcanoes have been mapped on Mars [1,2,3], and recent geologic studies [4] indicate structural evidence of deep-seated intrusive bodies (Fig. 1). Most volcanoes in the Tharsis region are volcanotectonic features: they have been associated with large-scale tectonic and volcanic processes. They occur along complex systems of faults and grabens having a dominant northeast-southwest trend closely coincident with a great circle [5], which extends along 90° of arc from Tempe Patera to probable volcanic mountains near lat 40° S., long 150°. Olympus Mons, Alba Patera, and a small volcano between them are aligned nearly parallel to the Tharsis axial trend; the boundary of the Martian crustal dichotomy is largely covered by young lava flows in this region but appears to lie within the corridor between these two trends. Clusters of relatively small volcanoes occur around the south end of the Tharsis rise, particularly in the Thaumasia area where ancient rocks are transected by networks of intersecting faults.

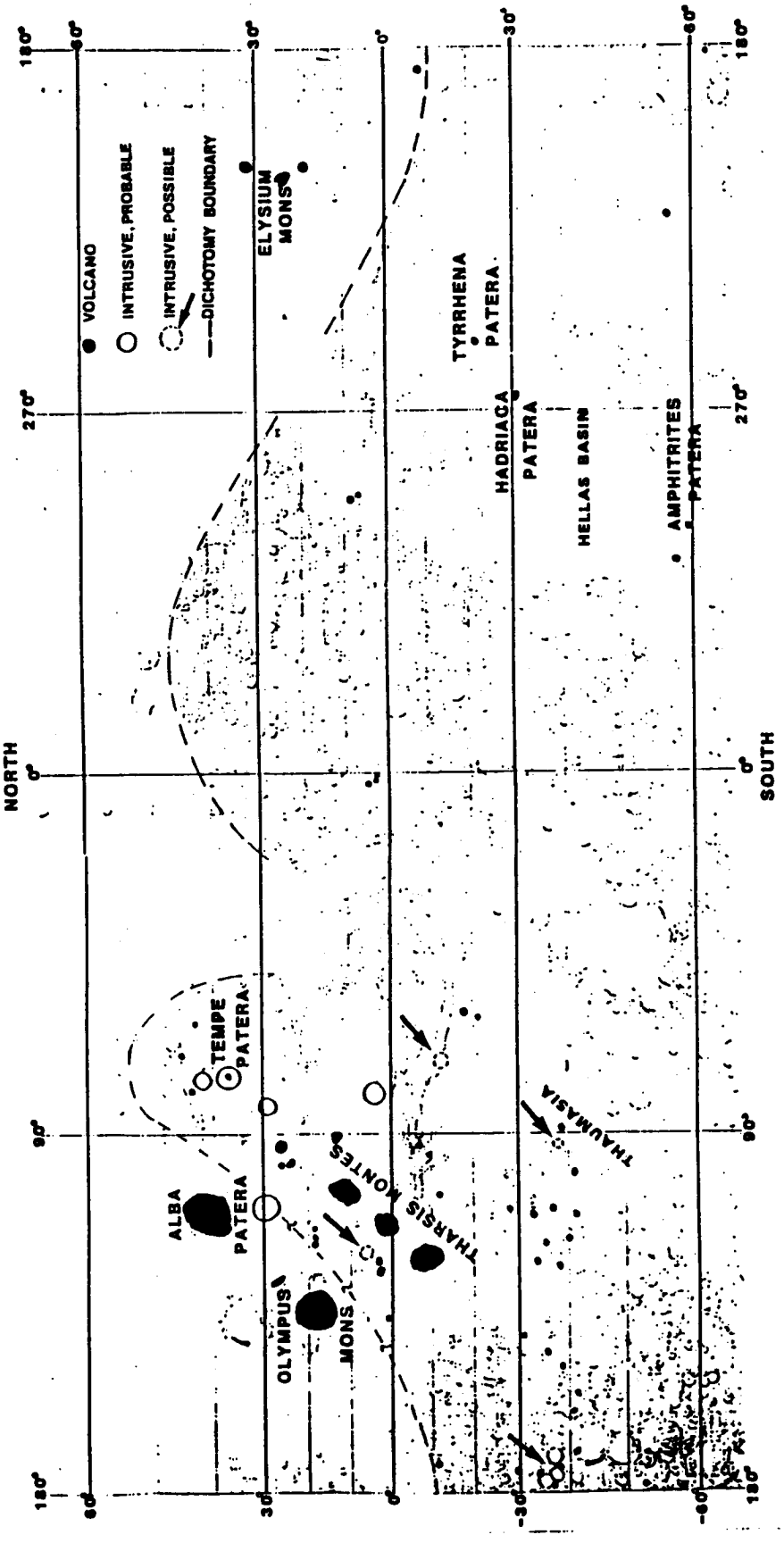
Deep-seated intrusive bodies are also concentrated in the Tharsis region and are recognized mostly where faults have been deflected around their cores. The intrusives have no observable topographic expression or associated lava flows except for Tempe Patera [6], a relatively small volcano that appears to be the surface expression of a much broader and older intrusive body. Three large, circular, rimless structures clustered in the southwestern part of the Tharsis region (Fig. 1) do not resemble impact craters and may be volcanotectonic depressions [7].

The Elysium Mons-Amphitrites Patera volcanic alignment is subparallel to that of Tharsis but is longer, extending through about 120° of arc; it transects the dichotomy boundary and is radial to the Hellas basin. Unlike the Tharsis trend, however, it is not associated with recognizable fault or graben systems. No evidence of intrusive bodies has been found along this trend or in the entire eastern region of Mars. Several volcanoes occur in the south polar region [3] but here, too, no major fault trends or intrusives are present. Many small volcanoes and pyroclastic cones occur in the northern lowland plains, but even medium-size (≈50-km-diameter) volcanotectonic structures are not discernible; if they exist, lava flows of Late Hesperian and Amazonian age have probably obscured all evidence of their presence.

Volcanoes in the Tharsis region have the widest age range (Early Noachian-Late Amazonian) of all volcanoes on Mars, as determined by the size-frequency distribution of their craters having diameters of 2, 5, and 16 km. Volcanotectonic intrusive centers in the Tempe area are Middle Noachian to Late Hesperian, as indicated by faults of these ages that have been partly deflected around their centers. Volcanoes in the eastern hemisphere are Hesperian to Early Amazonian.

References

[1] Scott D.H. and Tanaka K.L. (1986) U.S. Geol. Misc. Inv. Ser. Map I-1802A. [2] Greeley R. and Guest J.E. (1987) U.S. Geol. Survey Misc. Inv. Ser. Map I-1802B. [3] Tanaka K.L. and Scott D.H. (1987) U.S. Geol. Survey. Misc. Inv. Ser. Map I-1802C. [4] Scott D.H. and Dohm J.M. (in press) Lunar and Planet. Sci. Conf. 20. [5] Wise D.U., Golombek M.P., and McGill, G.E. (1979) Icarus, 38, p. 456-472. [6] Plescia J.B. and Saunders R.S. (1979) Proc. Lunar Planet. Sci. Conf. 10, p. 2841-2859. [7] Scott D.H. (1982) Jour. Geophys. Res., 87, p. 9839-9851.



VOLCANOTECTONIC FEATURES ON MARS

FIGURE 1